

REMARKS

Claims 1-41 are currently pending. Claims 10, 12, 21, 23, and 34 have been amended. Applicants acknowledge and appreciate the Examiner's indication that claims 10-15, 21-26, 34, and 36-39 contain allowable subject matter.

Applicants have amended claims 10, 12, 21, 23, and 34 to include all the limitations of the base claim and any intervening claims. As such, claims 10, 12, 21, 23, and 34 are in a condition for allowance. Applicants have also amended claim 35 to correct a dependency error. In light of these amendments, claims 11, 13-15, 22, 24-26, and 35-39 depend from allowable claims and as such are also allowable.

The Examiner rejected claim 2 under 35 U.S.C. §112, second paragraph. Applicants have amended claim 2 to clarify the claim. Specifically, a "second housing" has been amended to read a "compressor housing."

The Examiner rejected claims 1, 4-8, 30-31, and 41 under 35 U.S.C. §102(b) as being anticipated by Birch (U.S. Patent No. 5,261,289).

Amended claim 1 defines a microturbine engine that includes a turbine having a first housing and a first rotor. A generator includes a second housing and a generator rotor. The generator rotor is supported for low-speed rotation by a low-speed bearing. A gearbox includes a third housing connected to the first housing and the second housing, a pinion gear, and a low-speed gear connected to the generator rotor and at least partially supported by the low-speed bearing. A shaft is connected to the first rotor and the pinion gear. A first high-speed bearing and a second high-speed bearing are positioned to support the first rotor and the shaft for high-speed rotation. The first high-speed bearing and the second high-speed bearing directly support the first rotor and no bearing directly supports the shaft.

Birch does not teach or suggest a microturbine engine that includes a shaft that is connected to a pinion gear and a first rotor, with no bearing directly supporting the shaft. Rather, Birch discloses a high-reduction gear assembly that includes a shaft 14 that is presumably driven by a first shaft, which is not shown. The shaft 14 includes a pinion gear 11 and is directly supported for high-speed rotation by two high-speed bearings 15 and 16. Thus, there are bearings supporting the shaft, contrary to the recited claim limitation of no bearing directly supporting the shaft.

In light of the foregoing, Birch does not teach or suggest each and every limitation of claim 1. As such, claim 1 is allowable over Birch. In addition, claims 2-9 and 16 depend from claim 1 and are allowable over Birch for these and other reasons.

Amended claim 30 defines a method of coupling a rotating element of an engine that operates at a first speed to a driven component that operates at a second speed. The second speed is slower than the first speed. The method includes coupling a shaft to the rotating element and supporting the rotating element and the shaft with a first high-speed bearing and a second high-speed bearing. At least a portion of the rotating element is disposed in a space between the bearings, and at least a portion of the rotating element and the shaft are disposed in a space beyond the bearings such that the shaft is not directly supported by a bearing. The method also includes engaging a second end of the shaft with a plurality of planetary gears, supporting the driven component with at least one low-speed bearing, and coupling a low-speed gear to the driven component. The low-speed gear is coupled to each of the planetary gears.

Birch does not teach or suggest coupling a shaft to a rotating element of an engine and positioning the shaft in a space beyond the bearings such that no bearing directly supports the

shaft. Rather, Birch discloses a high-reduction gear assembly that includes a shaft 14 that is presumably connected to the rotating element of an engine. The shaft 14 is directly supported by a pair of bearings 15, 16 and is not disposed in a space beyond the bearings such that the shaft is not directly supported by a bearing.

In light of the foregoing, Birch does not teach or suggest each and every limitation of claim 30. As such, claim 30 is allowable over Birch. In addition, claims 31-33 and 40-41 depend from claim 30 and are allowable over Birch for these and other reasons.

The Examiner rejected claims 1-2, 30-31, and 41 under 35 U.S.C. §102(b) as being anticipated by Gordon (U.S. Patent No. 6,073,857).

As discussed with regard to the Birch rejection, claim 1 defines a microturbine engine that includes, among other things, a first high-speed bearing and a second high-speed bearing that are positioned to support the first rotor and the shaft for high-speed rotation. The first high-speed bearing and the second high-speed bearing directly support the first rotor and no bearing directly supports the shaft.

Gordon does not teach or suggest an engine that includes a first rotor supported by first and second high-speed bearings and a shaft coupled to the first rotor but not directly supported by a bearing. Rather, Gordon discloses an engine that includes a front seal carrier 102 that rotates with a compressor shaft. A bearing assembly 146 directly supports one end of the front seal carrier 102 and one end of the shaft that supports the pinion gear 64. Thus, contrary to claim 1, Gordon teaches a bearing that directly supports the shaft that supports the pinion gear.

In light of the foregoing, Gordon does not teach or suggest each and every limitation of claim 1. As such, claim 1 is allowable over Gordon. In addition, claims 2-9 and 16 depend from claim 1 and are allowable over Gordon for these and other reasons.

As discussed with regard to the Birch rejection, claim 30 defines a method that includes, among other things, positioning a rotating element in a space between the bearings, and positioning at least a portion of the rotating element and the shaft in a space beyond the bearings such that the shaft is not directly supported by a bearing.

Gordon does not teach or suggest coupling a shaft to a rotating element of an engine and positioning the shaft in a space beyond the bearings such that no bearing directly supports the shaft. Rather, Gordon discloses coupling a shaft to a rotating element and directly supporting both the shaft and the rotating element with a high-speed bearing assembly 146. Thus, Gordon teaches away from an arrangement in which the shaft is not directly supported by a bearing.

In light of the foregoing, Gordon does not teach or suggest each and every element of claim 30. As such, claim 30 is allowable over Gordon. In addition, claims 31-33 and 40-41 depend from claim 30 and are allowable over Gordon for these and other reasons.

The Examiner rejected claims 3 and 40 under 35 U.S.C. §103(a) as being unpatentable over Birch in view of Gordon.

Claim 3 depends from claim 1 and claim 40 depends from claim 30. As discussed with regard to the 35 U.S.C. §102(b) rejections, neither Birch nor Gordon teach or suggest the subject matter of claim 1 or claim 30. In fact, both Birch and Gordon disclose a shaft that supports the pinion gear and that is directly supported by at least one bearing. Thus, both

Birch and Gordon teach away from providing a shaft that supports a pinion but that is not directly supported by a bearing.

In light of the foregoing, Birch and Gordon, alone or in combination, do not teach or suggest each and every limitation of claim 1 or claim 30. As such, claim 3 and claim 40 are allowable.

The Examiner rejected claim 9 under 35 U.S.C. §103(a) as being unpatentable over Gordon in view of Profant (British Patent No. GB 2,078,338).

Claim 9 depends from claim 1 and adds that the shaft is a quill shaft. As discussed with regard to the 35 U.S.C. §102(b) rejection, Gordon does not teach or suggest a pinion-supporting shaft that is not directly supported by a bearing. Rather, Gordon teaches a shaft that supports a pinion gear and that is directly supported at one end by a bearing.

Profant does not cure the deficiencies of Gordon. Profant discloses a composite quill shaft for use with a gas turbine. Profant teaches that the bearings that are used could be spaced further from one another if the shaft of Profant is employed. However, Profant makes no mention of using the shaft without any direct support from a bearing.

In light of the foregoing, Gordon and Profant, alone or in combination, do not teach or suggest each and every limitation of claim 1. As such, claim 1 and claim 9 are allowable.

The Examiner rejected claims 16 and 32-33 under 35 U.S.C. §103(a) as being unpatentable over Gordon in view of Brooks (U.S. Patent No. 5,526,640).

Claim 16 depends from claim 1 and claims 32-33 depend from claim 30. As discussed, Gordon does not teach or suggest all of the limitations of claim 1 or claim 30, much less the limitations of claims 16 and 32-33.

Brooks does not cure the deficiencies of Gordon. Brooks discloses a gas turbine engine that includes a compressor 228 and a turbine 230 that are interconnected by a shaft 232. Brooks does not teach or suggest supporting a pinion on a shaft and coupling that shaft to a rotor such that a bearing does not directly support the shaft.

In light of the foregoing, Gordon and Brooks, alone or in combination, do not teach or suggest each and every limitation of claim 1 or claim 30. As such, claim 1 and claim 30, as well as claims 16 and 32-33, which depend therefrom, are allowable.

The Examiner rejected claims 17-20 and 28-29 under 35 U.S.C. §103(a) as being unpatentable over Gordon in view of Profant and Birch.

Claim 17 defines a microturbine engine that includes, among other things, a quill shaft coupled to a rotor train and a pinion gear such that the quill shaft is fully supported by a second high-speed bearing and planetary gears. The quill shaft is disposed in the space beyond the bearings such that a bearing does not directly support the quill shaft.

As discussed above, Gordon does not teach or suggest a shaft that supports a pinion gear and that is disposed in a space beyond the bearings such that a bearing does not directly support the shaft.

Profant does not cure the deficiencies of Gordon. As discussed, Profant teaches a composite quill shaft. However, Profant makes no mention of positioning the quill shaft in a space beyond the bearings such that a bearing does not directly support the shaft.

Birch does not cure the deficiencies of Gordon and Profant. As discussed above, Birch discloses a high-reduction gear assembly that includes a high-speed shaft that supports a pinion gear. However, the high-speed shaft is directly supported by at least two bearings.

Thus, both Birch and Gordon teach a shaft that supports a pinion and that is directly supported by at least one bearing. Profant teaches nothing regarding the location of bearings.

In light of the foregoing, Gordon, Profant, and Birch, alone or in combination, do not teach or suggest each and every limitation of claim 17. As such, claim 17 is allowable. In addition, claims 18-20 and 28-29 depend from claim 17 and are also allowable.

The Examiner rejected claim 27 under 35 U.S.C. §103(a) as being unpatentable over Gordon in view of Profant, Birch, and Brooks.

Claim 27 depends from claim 17 and adds that a tie-bolt passes through at least a portion of the rotor flange, at least a portion of the turbine rotor, and the entire compressor rotor. The tie bolt engages the turbine rotor and the rotor flange to couple the turbine rotor, the compressor rotor, and the rotor flange for high-speed rotation.

As discussed above, Gordon, Profant, and Birch, alone or in combination, do not teach or suggest each and every limitation of claim 17, much less claim 27.

Brooks does not cure the deficiencies of Gordon, Profant, and Birch. Brooks discloses a gas turbine engine that includes a compressor 228 and a turbine 230 that are interconnected by a shaft 232. However, Brooks does not teach or suggest supporting a pinion on a shaft and coupling that shaft to a rotor such that a bearing does not directly support the shaft.

In light of the foregoing, Gordon, Profant, Birch, and Brooks, alone or in combination, do not teach or suggest each and every limitation of claim 17. As such, claim 17 is allowable. In addition, claim 27 depends from claim 17 and is also allowable.

CONCLUSION

In light of the foregoing, Applicants respectfully submit that claims 1-41 are allowable.

The undersigned is available for telephone consultation during normal business hours.

Respectfully submitted,



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